International Journal of Exploring Emerging Trends in Engineering (IJEETE)
Vol. 03, Issue 02, Mar-Apr, 2016 Pg. 139 – 142 WWW.IJEETE.COM

A REVIEW ON DETECTION OF MELANOMA

C.V.Longani[1], S.S.Deore[2]
Computer Dept., SRES COE, Savitribai Phule Pune University, India

Abstract
The word cancer is enough to send many people into a whirling state. However, most types of skin cancer have a very flattering prediction. They are common and can be treated. Melanoma is a type of skin cancer with most severe concern. Minor skin cancers often form a spot or sore that will be difficult to mend. Melanomas may emerge in a skin mole that preexist and has become darker or may change in its appearance. More often they can crop up as a new mole or a freckle that is not usually seen. Nearly all skin cancers are related to exposure towards excess of the Ultraviolet radiation. The depletion of the earth's ozone layer also forms to be the risk of developing skin cancer. With melanoma, family history also forms to be a factor of cause. Detection at the melanoma in early stage can serve the highest curable rate for melanoma. The aim of this paper is to provide the summary of the available methods and stages to identify melanoma.

Keywords:*Optical coherence tomography (OCT); Melanoma; ABCD, Dermotoscope.*

I. Introduction:

Malignant melanoma, known as the deadliest form of skin cancer, is one of the most rapidly increasing cancers in the world. In a report published in 2000, the World Health Organization (WHO) estimated that approximately 65,000 global deaths related to melanoma occurred that year. Invasive melanoma alone has an estimated incidence of 76,690 and an estimated total of 9,480 deaths in the United States in 2013 [1]. Melanoma is more aggressive as compared to Nonmelanomous skin cancer. Cutaneous melanoma is nothing but cancerous growth of melanocytes. These melanocytes are the cells that are found at the bottom of the epidermal layer of the skin. These melanocytes are responsible for producing the UV-absorbing pigment called melanin. Melanin is the pigment that determines a person's skin colour, including the effects of a "tan". Melanin has a large absorption band in the UV range of the electromagnetic (EM) spectrum. It restricts the entry of damaging UV radiation into the hypodermis.

Our interest for review in melanoma is due to the fact that its incidence has increased faster than that of almost all other cancers. Also the annual incidence rates have increased on the order of 3 − 7% in fair-skinned populations in previous years [2]. Early diagnosis is particularly important since melanoma can be cured with a simple excision if it is detected early. However, if detection is done late, the cancer can spread and the prognosis will be harsh and bleak. There are two factors that make it difficult for identification of melanoma visually: melanoma can be very similar in appearance to benign nevi or non-cancerous "moles" at the surface during its early to mid-stages; melanoma can take on extensively different shapes and forms.

In the previous days, the primary form of diagnosis for melanoma has been unaided clinical examination. If a suspicious lesion is identified on human body, the GP will refer the patient to see a dermatologist who uses dermotoscope to identify the lesion. Dermotoscope is a device that helps dermatologists by magnifying surface detail and filtering surface reflectance. In recent years, dermotoscopy has proved valuable in visualizing the morphological structures in pigmented lesions. Dermatologists use metrics such as the ABCD where A stands for 'Asymmery', B for 'Border' irregularity, C for 'Color' patterns, and D for 'Diameter'. .

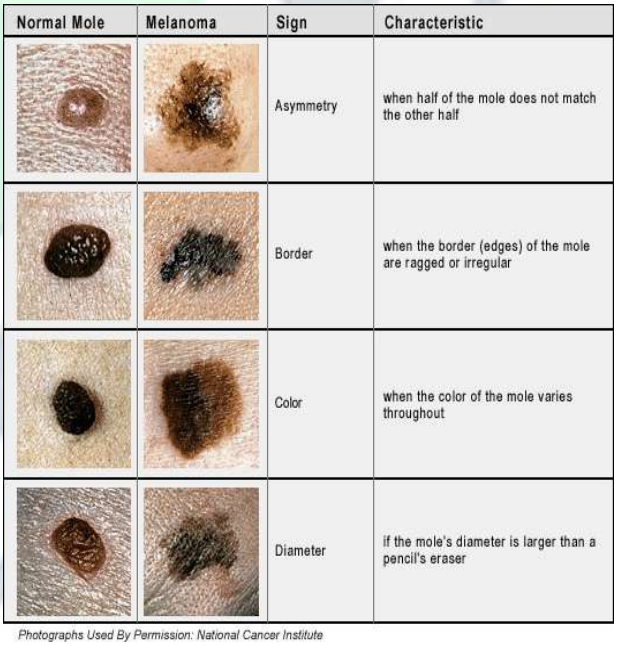

Figure1: Normal mole vs. Melanoma

Dermatologists further prescribe biopsy to diagnose them. Biopsy is a simple method to recognize the type of disease in skin. But it is an

invasive method, and in elongated time it leads to ache and discomfort for patients. Also, it has also been shown that dermotoscopy is difficult to learn and is subjective, it leads to large variation among inter-observers. Unfortunately, also the clinical use of dermatoscopes is limited to an extent. Other techniques include OCT, spectral imaging. OCT is particularly useful for determining the depth of melanoma penetration, which is indicative of growth in vertical direction. Newer technologies such as infrared imaging, multispectral imaging, and confocal microscopy, have come to the use in recent days for providing greater diagnostic accuracy. These imaging technologies can serve as a helping hand to physicians and provide automated skin cancer screening. Although computerized techniques cannot as yet provide a perfect diagnosis, they can be used to improve decision making for biopsy as well as early melanoma detection, especially for patients with multiple atypical nevi. With rising incidence rates and subjectivity in current clinical detection methods, there is a need for decision support systems to detect melanoma. The goal of this paper is to abridge the state of the art in the use of computer vision techniques so as to the detect the presence of skin cancer.

II. Methods for the Detection of Skin Cancer: A survey

In decision support systems for detection of skin cancer, illumination correction can be used for preprocessing. The presence of variation in illumination in the images can have poor impact on lesion segmentation and can degrade performance of classification. The illumination correction aims at adjusting the original image data (i.e., pixel values) so as to standardize the lighting exposure across the entire image [4]. An important preprocessing step for the images with skin lesion is Illumination correction. It has to be done prior to segmentation and classification algorithms. If the step of preprocessing using Illumination correction is skipped, healthy skin areas that are obstructed by shadows will appear similar in color as the skin lesion. This may result in misclassification of those infected areas. Jeffrey Glaister et.al. has proposed a novel multistage illumination modeling algorithm so as to correct the underlying illumination variation in skin lesion images [4].

Segmentation refers to the process of classifying the pixels in an image into different semantic groups. In the case of skin lesion analysis, we need to determine the border that separates the skin lesion from the surrounding tissues that are healthy. The result is a binary mask that surrounds the skin lesion. Skin lesion segmentation from the background skin must be accurate. Some of the features anticipated to be used for diagnosis deal with shape of the lesion and others deal with the color of the lesion rather with the color of the surrounding skin. In [5], gradient vector flow (GVF) snakes are investigated. GVF snakes are used to find the border of skin lesions in images that are obtained using dermoscopy. An automatic initialization method is introduced in [5] so as to make the process of determining skin lesion border fully automated.

Feature extraction involves performing specific pre-defined calculations on the preprocessed and segmented image. The goal is to generate a feature vector (i.e., a vector of real numbers) from the image that aptly describes important characteristics of the image. Thus each image is represented by a point in some n-dimensional space. In the conventional procedure, the diagnosis methods mainly used are ABCD rule of Dermoscopy; pattern analysis; Menzies method; seven-point checklist; and texture analysis. Many skin cancer feature extraction methods propose features that model the ABCD criteria used by doctors in clinical settings. , the feature sets are fairly basic, consisting of many low-level features that are combined to try to approximate ABCD. The ABCD rule detects the asymmetry (A), border (B), color (C), and differential structures (D) of the lesion that forms the basis for a identification by a dermatologist. The pattern analysis method aims to detect specific patterns. These patterns can be global (reticular, globular, cobblestone, homogeneous, starburst, parallel, multicomponent, nonspecific) or local (pigment network, dots/globules/ moles [7], streaks, blue-whitish veil, regression structures, hypopigmentation, blotches, vascular structures). The Menzies method uses negative features which are symmetry of pattern, presence of a single color and positive which are blue-white veil, multiple brown dots, pseudopods, radial streaming, scar-like depigmentation, peripheral black dots/globules, multiple (five to six) colors, multiple blue/gray dots, broadened network). The seven-point checklist [7] uses seven criteria. The seven criteria is used to identify the chromatic characteristics and the shape and/or texture of the lesion. These criteria include a typical pigment network, blue-whitish veil, atypical vascular pattern, irregular streaks, irregular

dots/globules, irregular blotches, and regression structures. Each one of the criteria affects the final judgment with a different weight. Texture analysis aims at quantifying texture notions like "fine," "rough," and "irregular" and to identify, measure. The statistics computed over different sub regions can be used to discriminate different textures [7].

Gain of using LLFs is that the features do not require significant time to be designed. However, the increased dimensionality of the feature space leads to many problems, such as: the "curse of dimensionality", increased computational complexity, and possible over fitting required due to the scarcity in the feature space. Most of the times, the feature sets that are used for analyzing standard camera images include low-level features. These low level features are present in high dimensional feature spaces and these features limit the system's ability to retrieve intuitive diagnostic rationale. HLIFs when mixed with a set of low level features gives more semantic meaning to the feature set, and allows the system to provide intuitive rationale for the classification decision[9].

A set of high-level intuitive features (HLIFs) has been proposed that describe melanoma quantitatively in standard camera images [8]. Robert Amerald et.al. in [8] has proposed HLIFs to model the ABCD criteria that is mostly used by dermatologists. The idea is that each HLIF represents characteristic that can be easily observed by human eye. Using this way, intuitive diagnostic rationale can be delivered to the user. HLIFs are termed as feature calculations. These have been modeled to describe some characteristics that can be recognized by humans, and from which rationale can be communicated to the user in some intuitive or visual manner. Designing HLIFs allows the system to represent its diagnosis in terms of objective, understandable steps both quantitatively (i.e., raw feature score) and qualitatively (i.e., description of the feature score). Furthermore, it simplifies the feature selection process, as each HLIF is designed according to human interpretation of the data[10].

Optimum threshold segmentation algorithm algorithms to precisely portray the cancerous area from the skin images. This algorithm is based on type-2 fuzzy sets. By using the 3D colour constancy algorithm, the effect of colour changes and shadows due to skin tone variation in the image can be significantly reduced in the preprocessing stage[6].Howard Lee·Yi-Ping et.al. applied the optimum thresholding technique to the preprocessed image over the RGB channels. Further they combined individual results to achieve the overall segmentation of skin cancer [6].

In machine learning, "classification" relates to a body of methods that takes as input a feature vector and outputs a predicted class (e.g., malignant or benign). In supervised learning, the ground-truth class of each datum is known. The classifier is usually trained (i.e., fit) using a subset of this data and tested on the other part of the data. This ensures that the classifier is able to generalise to new instances rather than strictly conforming to the training data (called overfitting). Support vector machines (SVM) is a classification scheme that is widely adopted in many machine learning settings due to its robustness and intuitive theory. The basic SVM setup is a linear classification problem. In this feature space a linear decision surface is constructed. SVM can be made into a non-linear classifier by applying a projection kernel into the SVM formulation [12]. Furthermore, artificial neural networks (ANN),decision trees, and k-nearest neighbour (K-NN) methods also can be used for classification.

III. Conclusion:

Melanoma is the most threatening type of skin cancer. Melanomas may arise in a skin mole that preexist and has become darker or changed in appearance or as a new mole also. Diagnosis if done at initial stage is particularly helpful since melanoma can be cured with a simple excision if detected at initial stages. However, if identified late, the cancer can spread and the prognosis is bleak and be unfavorable. In this survey paper, the technique to detect benign and melanoma is discussed. Both low level and high level features can be used for the same. The increased dimensionality of the feature space leads to many problems. The "curse of dimensionality", increased computational complexity, and possible overfitting due to the sparsity of the feature space may be resulted due to use of low level features. HLIFs are feature calculations that have been meticulously modeled to describe some characteristic that can be easily observed by human, and of which rationale can be relayed to the user in some intuitive or visual manner. The accuracy for classifying Skin lesion can

be improved by concatenating a small set of HLIFs to a state-of-the-art low-level feature set. HLIFs can provide means for conveying diagnostic rationale to the user. ANN, KNN, SVM can be used for classification of normal and melanomous nevi.

IV. References:

[1] Siegel, R., Naishadham, D., Jemal, A.: Cancer statistics. CA Cancer J. Clin. 63(1), 11–30 (2013)

[2] S.K. Tasoulis, C.N. Doukas, I. Maglogiannis, and V.P. Plagianakos: "Independent Component Clustering for Skin Lesions Characterization" SpringeR

[3] http://www.dermatology.ucsf.edu

[4] Jeffrey Glaister, Robert Amelard, Alexander Wong,and David A. Clausi "MSIM: Multistage Illumination Modeling of Dermatological Photographs for Illumination-Corrected Skin Lesion Analysis" IEEE TRANSACTIONS ON BIOMEDICAL ENGINEERING, VOL. 60, NO. 7, JULY 2013

[5] B. Erkol, R. H. Moss, R. Joe Stanley, W. V. Stoecker, and E. Hvatum, "Automatic lesion boundary detection in dermoscopy images using gradient vector flow snakes," Skin Research and Technology, vol. 11, no. 1, pp. 17–26, 2005.

[6] Howard Lee·Yi-Ping, Phoebe Chen "Skin cancer extraction with optimum fuzzy thresholding technique "15 September 2013 © Springer Science+Business Media New York 2013.

[7] Maglogiannis and C. N. Doukas, "Overview of advanced computer vision systems for skin lesions characterization," Information Technology in Biomedicine, IEEE Transactions on, vol. 13, no. 5, pp. 721–733, 2009.

[8] Robert Amelard, Jeffrey Glaister, Alexander Wong, David A. Clausi, "High-Level Intuitive Features (HLIFs) for Intuitive Skin Lesion Description" IEEE TRANSACTIONS ON BIOMEDICAL ENGINEERING, VOL. 62, NO. 3, MARCH 2015.

[9] Robert Amelard, Alexander Wong, David A. Clausi, "Extracting Morphological High-Level Intuitive Features (HLIF) for Enhancing Skin Lesion Classification"

[10] Robert Amelard, Alexander Wong, David A.Clausi,"Extracting High level Intuitive Features(HLIF) For Classifying Skin Lesions Using Standard Camera Images"

[11] J.Premaladha,K.S.Ravichandran, "Assymmetry Analysis of Malignant Melanoma Using Image Processing: A Survey", J.Artif.Intel,2014

[12] C. Cortes and V. Vapnik, "Support-vector networks," Machine Learning, vol. 20, pp. 273–297, 1995.

AUTHOR'S BIBLOGRAPHY

C. V. Longani completed her Bachelor's degree in the year 2006. Further she has perceived masters in Computer Science Engineering in the year 2012. Currently she is working as an Assistant Professor in SRES COE, SPPU. She is serving the institute since last 8 years. Her area for research is Image Processing.

S .S. Deore completed her Bachelor's degree in the year 2005. Further she has perceived masters in Computer Science Engineering in the year 2011. Currently she is working as an Assistant Professor in SRES COE, SPPU. She is serving the institute since last 8 years. Her area for research is Video Processing.

